WE CLAIM:

1. An apparatus for rapid cure of sol-gel coatings adhered to a substrate, the apparatus comprising:

a supporting structure;

a heating source mounted on the supporting structure and configured to generate a predetermined heating pattern; and

a transfer assembly configured to sequentially expose portions of the coated substrate to the heating pattern at a selected distance and for a selected duration, such that the heat energy sufficiently cures or densifies the sol-gel coating, but does not unduly heat the substrate to cause deformation.

2. An apparatus as defined in claim 1, wherein the transfer assembly is configured to transport the coated substrate past the heating source and the substrate is transported at a speed in the range of about 0.5 to about 50 centimeters per second.

3. An apparatus as defined in claim 1, wherein the heating source is an IR source configured to emit IR radiation in a predetermined pattern.

4. An apparatus as defined in claim 3, wherein the IR source emits IR radiation at a power level in the range of about 40 to about 80 watts per centimeter.

5. An apparatus as defined in claim 1, wherein the heating source is a gas nozzle connected to a heated gas source, and configured to expel a heated gas stream in a predetermined pattern.

6. An apparatus as defined in claim 5, wherein further the gas is selected from the group consisting of air, nitrogen, argon, helium, and combinations thereof.

7. An apparatus as defined in claim 5, wherein the heated gas source is configured to allow injecting steam, or other water forms, into the heated gas stream.

8. An apparatus as defined in claim 5, wherein the temperature of the heated gas stream is in the range of about 100 to about 500° C and the flow rate of the heated gas stream is in the range of about 50 to about 10,000 cubic centimeters per second.

9. An apparatus as defined in claim 1, wherein the heating source includes

an IR source mounted on the supporting structure and configured to emit IR radiation in a predetermined pattern, and

a gas nozzle mounted on the supporting structure in spaced relationship from the IR source, connectable to a heated gas source, and configured to expel a heated gas stream in a predetermined pattern.

10. An apparatus as defined in claim 9, wherein the transfer assembly is configured to transport the coated substrate past the IR source and the gas nozzle and the substrate is transported at a speed in the range of about 0.5 to about 50 centimeters per second.

11. An apparatus as defined in claim 9, wherein the IR source emits IR radiation at a power level in the range of about 40 to about 80 watts per centimeter.

12. An apparatus as defined in claim 9, wherein the IR source is two IR lamps in opposed relation to each other such that the coated substrate can pass therebetween at a selected distance from both.

13. An apparatus as defined in claim 9, further including a second gas nozzle in opposed relation to the first gas nozzle such that the coated substrate can pass therebetween at a selected distance from both.

14. An apparatus as defined in claim 9, wherein the substrate is a plastic material having a low melting point, wherein the plastic material is selected from the group consisting of polymethyl methacrylate, polycarbonate, polyester, and CR-39.

15. An apparatus as defined in claim 9, further including a heated gas source connected to the gas nozzle.

16. An apparatus as defined in claim 15, wherein the gas is selected from the group consisting of air, nitrogen, argon, helium, and combinations thereof.

17. An apparatus as defined in claim 15, wherein the heated gas source is configured to allow injecting steam, or other water forms, into the heated gas stream.

18. An apparatus as defined in claim 15, wherein the temperature of the heated gas stream is in the range of about 100 to about 500° C and the flow rate of the heated gas stream is in the range of about 50 to about 10,000 cubic centimeters per second.

19. A process for rapidly curing a sol-gel coating adhered to a substrate, comprising sequentially exposing the coated substrate to a heating source at a selected distance and at a selected rate, wherein the heat energy sufficiently cures or densifies the sol-gel coating to its optimum physical and optical properties, but does not unduly heat the substrate to cause deformation.

20. A product produced by the process of claim 19.

21. A process as defined in claim 19, wherein the coated substrate is transported past the heating source and the substrate is transported at a speed in the range of about 0.5 to about 50 centimeters per second.

22. A process as defined in claim 19, wherein the heating source is an IR source configured to emit IR radiation in a predetermined pattern.

23. A process as defined in claim 19, wherein the IR source emits IR radiation at a power level in the range of about 40 to about 80 watts per centimeter.

24. A process as defined in claim 19, wherein the heating source is a gas nozzle connectable to a heated gas source, and configured to expel a heated gas stream in a predetermined pattern.

25. A process as defined in claim 24, wherein the gas is selected from the group consisting of air, nitrogen, argon, helium, and combinations thereof.

26. A process as defined in claim 24, wherein the heated gas source is configured to allow injecting steam, or other water forms, into the heated gas stream.

27. A process as defined in claim 24, wherein the temperature of the heated gas stream is in the range of about 100 to about 500° C and the flow rate of the heated gas stream is in the range of about 50 to about 10,000 cubic centimeters per second.

28. A process as defined in claim 19, wherein the heating source includes an IR source and a heated gas stream.

29. A product produced by the process of claim 28.

30. A process as defined in claim 28, wherein the process is repeated to produce a product having multiple layers of sol-gel coatings.

31. A process as defined in claim 28, wherein the substrate is a plastic material having a low melting point, wherein the plastic material is selected from the group consisting of polymethyl methacrylate, polycarbonate, polyester, and CR-39.

32. A process as defined in claim 28, wherein the heated gas is selected from the group consisting of air, nitrogen, argon, helium, and combinations thereof.

33. A process as defined in claim 28, and further comprising introducing moisture into the curing process by injecting steam, or other water forms, into the heated gas stream.

34. A process as defined in claim 28, wherein the temperature of the heated gas stream is in the range of about 100 to about 500° C and the flow rate of the heated gas stream is in the range of about 50 to about 10,000 cubic centimeters per second.

35. A process as defined in claim 28, wherein the substrate is sequentially exposed the IR source and the heated gas stream at a speed in the range of about 0.5 to about 50 centimeters per second.

36. A process as defined in claim 28, wherein the IR source emits IR radiation at a power level in the range of about 40 to about 80 watts per centimeter.

37. A process as defined in claim 28, wherein the sol-gel coating forms an optical coating and/or an abrasion coating.

38. A process as defined in claim 37, wherein the optical coating is a multi-layer optical stack that produces an antireflection coating.